## WHAT IS CLAIMED IS:

- 1. An electrode for use in the detection of an analyte by electrochemiluminescence comprising a composite containing a polymer matrix and a multiplicity of carbon particles dispersed therein, said electrode having a binding domain containing a reagent capable of binding a component of a binding electrochemiluminescence assay.
- 2. An electrode as recited in claim 1, wherein the carbon particles comprise from 0.5% to 50% by weight of the composite.
- 3. An electrode as recited in claim 1, wherein the carbon particles comprise from 1% to 30% by weight of the composite.
- 4. An electrode as recited in claim 1, wherein the carbon particles comprise from 2% to 20% by weight of the composite.
- 5. An electrode as recited in claim 1, wherein said composite is molded.
- 6. An electrode as recited in claim 1, wherein said composite is extruded.
- 7. An electrode as recited in claim 1, wherein said reagent is covalently bound to said electrode.
- 8. An electrode as recited in claim 1, wherein said reagent is non-covalently bound to said electrode.

- 9. An electrode as recited in claim 1, wherein said reagent is directly immobilized on said electrode.
- 10. An electrode as recited in claim 1, wherein said reagent is indirectly immobilized on said electrode via a binding pair.
- 11. An electrode as recited in claim 1, wherein said electrode includes a multiplicity of binding domains.
- 12. An electrode as recited in claim 1, wherein said binding reagent is an antibody or fragment thereof, a nucleic acid, a receptor or an enzyme.
- 13. An electrode as recited in claim 1, wherein said carbon particles are fibrils.
- 14. An electrode as recited in claim 1, wherein said electrochemiluminescence assay is a homogeneous assay.
- 15. A method for the manufacture of an electrode for use in the detection or quantitation of an analyte by electrochemiluminescence comprising the steps of:
  - (a) treating a composite containing a matrix and a multiplicity of carbon particles dispersed therein with a plasma, and
  - (b) forming a binding domain on the so-treated composite containing a reagent capable of binding a component of a binding electrochemiluminescence assay.

- 16. A method as recited in claim 15, wherein two or more sequential plasma treatments are conducted.
- 17. A method as recited in claim 15, wherein the plasma contains an atom or compound selected from the group consisting of  $O_2$ , Ar,  $H_2O$ ,  $N_2$ ,  $NH_3$ ,  $CF_4$ ,  $SF_6$ ,  $C_2F_6$ ,  $CHF_3$ ,  $CF_2Cl_2$ ,  $CF_3Br$ ,  $CF_3Cl$  and combinations thereof.
- 18. A method as recited in claim 15, wherein said plasma treatment is for one or more of the purposes of: (a) etching said polymer, or (b) derivatizing the exposed surfaces of the carbon particles dispersed in said polymer.
- 19. A method as recited in claim 15, wherein said matrix is a polymer.
- 20. A method as recited in claim 15, wherein said carbon particles are fibrils.
- 21. A method as recited in claim 15, wherein said binding domain is formed by introducing said reagent through a hole in a mask placed on said composite.
- 22. A method for the manufacture of an electrode for use in the detection of an analyte by electrochemiluminescence comprising the steps of:
  - (a) treating a composite containing a matrix and a multiplicity of carbon particles dispersed therein with a chemical reagent, and

- (b) forming a binding domain on the so-treated composite containing a reagent capable of binding a component of a binding electrochemiluminescence assay.
- 23. A method as recited in claim 22, wherein said matrix is a polymer.
- 24. A method as recited in claim 22, wherein said carbon particles are fibrils.
- 25. A method as recited in claim 22, wherein said chemical reagent is an oxidizing agent.
- 26. A method as recited in claim 22, wherein said binding domain is formed by introducing said reagent through a hole in a mask placed on said compsite.
- 27. An electrode for use in the detection of an analyte by electrochemiluminescence prepared by the method of claim 15.
- 28. An electrode for use in the detection of an analyte by electrochemiluminescence prepared by the method of claim 22.
- 29. A cartridge for use in an instrument system for conducting electrochemiluminescence assays for the detection or quantitation of an analyte, comprising: one or more electrodes each comprising a polymer matrix and a multiplicity of carbon particles dispersed therein, each of said one or more electrodes having one or a plurality of binding domains, each of said

domains containing a reagent capable of binding a component of a binding electrochemiluminescence assay.

- 30. A cartridge as recited in claim 29, which does not contain a liquid assay reagent.
- 31. A cartridge as recited in claim 29, containing in addition to said one or more electrodes, a dry assay reagent.
- 32. A cartridge as recited in claim 31, wherein said dry assay reagent is an electrochemiluminescence coreactant.
- 33. A cartridge as recited in claim 31, wherein said assay reagent is a buffer.
- 34. A cartridge as recited in claim 31, wherein said assay reagent contains an electrochemiluminescent moiety.
- 35. A cartridge as recited in claim 31, wherein said reagent is a calibration standard.
- 36. A cartridge as recited in claim 31, wherein said reagent is a preservative.
- 37. A cartridge as recited in claim 31, wherein said reagent is a carbohydrate.
- 38. A cartridge as recited in claim 29, wherein said electrode defines an interior wall of a cell for containing a liquid sample.
- 39. A cartridge as recited in claim 29, including a window for passage of light from said cartridge to means for detecting light from said assay.

- 40. A cartridge as recited in claim 29, including fluid metering means.
- 41. A cartridge as recited in claim 29, including means for modulating the temperature of said cartridge.
- 42. A cartridge as recited in claim 29, including means for determining the temperature of said cartridge.
- 43. A cartridge as recited in claim 29, including a fluid path.
- 44. A cartridge as recited in claim 29, including a counter electrode.
- 45. A cartridge as recited in claim 29, including a reference electrode.
- 46. A cartridge as recited in claim 29, including a source of electrical energy.
- 47. A cartridge as recited in claim 29, including means for containment of a fluid sample introduced to said cartridge.
- 48. A cartridge as recited in claim 29, which is injection molded.
- 49. A cartridge as recited in claim 29, which is disposable.
- 50. A cartridge as recited in claim 29, including means for mixing contents thereof.
- 51. A cartridge as recited in claim 50, wherein said means for mixing is a sonication device.

- 52. A cartridge as recited in claim 51, wherein said sonication device is a piezoelectric device structurally coupled to the electrode in said cartridge.
- 53. A cartridge as recited in claim 29, wherein said electrochemiluminescence assay is homogeneous.
- 54. An instrument system for conducting electrochemiluminescence assays for the detection or quantitation of an analyte comprising:
  - (a) a cartridge including one or more electrodes each comprising a composite containing a polymer matrix and a multiplicity of carbon particles dispersed therein, each of said one or more electrodes having one or a plurality of binding domains, each of said domains containing a reagent capable of binding a component of a binding electrochemiluminescence assay; and
  - (b) means for selectively detecting or quantitating light from each of said binding domains.
- 55. An instrument system as recited in claim 54, wherein said carbon particles are fibrils.
- 56. An instrument system as recited in claim 54, including means for mixing contents of said cartridge.

- 57. An instrument system as recited in claim 54, wherein said cartridge includes a dry assay reagent.
- 58. An instrument as recited in claim 54, wherein said means for detecting or quantitating light is a CCD.
- 59. An instrument as recited in claim 54, wherein said means for detecting or quantitating light is a photodiode.
- 60. An instrument as recited in claim 54, including temperature control means for controlling the temperature of said cartridge.
- 61. An instrument system for conducting electrochemiluminescence assays for the detection or quantitation of an analyte comprising:
  - (a) a cartridge including one or more electrodes each comprising a composite containing a matrix and a multiplicity of carbon fibrils dispersed therein, each of said one or more electrodes having one or a plurality of binding domains, each of said domains containing a reagent capable of binding a component of a binding electrochemiluminescence assay;
  - (b) means for selectively detecting or quantitating light from each of said binding domains; and
  - (c) means for mixing contents of said cartridge.

- 62. An instrument system as recited in claim 61, wherein said mixing system is a sonication device.
- 63. An instrument system for conducting electrochemiluminescence assays for the detection or quantitation of an analyte comprising:
  - (a) a cartridge including one or more electrodes each comprising a composite containing a matrix and a multiplicity of carbon particles dispersed therein, each of said one or more electrodes having one or a plurality of binding domains, each of said domains containing a reagent capable of binding a component of a binding electrochemiluminescence assay;
  - (b) means for applying a potential at one or more of said electrodes;
  - (c) means for selectively detecting or quantitating light from said binding domains;
  - (d) electronic means to coordinate the application of a potential at one or more of said electrodes with the operation of said means for detecting or quantitating light from said binding domains; and

- (e) electronic means for storage or processing of information received form said light detecting or quantitation means.
- 64. An instrument system as recited in claim 63, including means for mixing contents of said cartridge.
- 65. An instrument system as recited in claim 63, wherein said cartridge includes a dry assay reagent.
- 66. An instrument system as recited in claim 63, wherein said carbon particles are fibrils.
- 67. An instrument system for conducting electrochemiluminescence assays for the detection or quantitation of an analyte, comprising:
  - (a) a cartridge including one or more electrodes each of said one or more electrodes having one or a plurality of binding domains, each of said domains containing a reagent capable of binding a component of a binding electrochemiluminescence assay;
  - (b) means for applying a potential at one or more of said electrodes;
  - (c) means for selectively detecting or quantitating light from said binding domains;
  - (d) electronic means to coordinate the application of a potential at one or more of said electrodes with the operation of said

- means for detecting or quantitating light from said binding domains; and
- (e) electronic means for storage or processing of information received form said light detecting or quantitation means.
- 68. An instrument system as recited in claim 67, including means for mixing the contents of said cartridge.
- 69. An instrument as recited in claim 67, including temperature control means for controlling the temperature of said cartridge.
- 70. An instrument system as recited in claim 67, wherein said cartridge includes a dry assay reagent.
- 71. An apparatus for use in the detection of an analyte comprising an electrode comprised of a composite of a matrix and a multiplicity of carbon fibrils dispersed therein and having a binding domain containing a reagent capable of binding a component of a binding assay.
- 72. An electrode for use in the detection of an analyte by electrochemiluminescence comprising a composite containing a matrix and a multiplicity of carbon fibrils dispersed therein, said electrode having a binding domain containing a reagent capable of binding a component of a binding electrochemiluminescence assay.

- 73. A solid phase support for immobilization of a biomolecule, comprising: a composite containing a matrix and a multiplicity of carbon fibrils dispersed therein.
- 74. A solid phase support as recited in claim 73, wherein said matrix is a polymer.
- 75. A solid phase support as recited in claim 73, wherein said support is used in the detection or quantitation of analyte.
- 76. A solid phase support as recited in claim 73, wherein an enzyme is immobilized on said support.
- 77. An electrode for use in the detection of an analyte by electrochemiluminescence comprising a matrix and a multiplicity of carbon fibrils dispersed therein, said electrode having a biomolecule immobilized thereupon.
- 78. A cartridge for use in an instrument system for conducting electrochemiluminescence assays for the detection or quantitation of an analyte, comprising: one or more electrodes each comprising a matrix and a multiplicity of carbon fibrils dispersed therein, each of said one or more electrodes having one or a plurality of binding domains, each of said domains containing a reagent capable of binding a component of a binding electrochemiluminescence assay.
- 79. A cartridge as recited in claim 71, containing in addition to said one or more electrodes, a dry assay reagent.

80. A method for conducting an electrochemiluminescence binding assay for detecting or measuring an analyte of interest in a sample comprising:

- (a) contacting an assay electrode with a sample and a component of said assay linked to an electrochemiluminescent label, said assay electrode:
  - (i) comprising a composite containing a polymer matrix and a multiplicity of carbon particles dispersed therein; and
  - (ii) having a binding domain containing a binding reagent, wherein said binding reagent is immobilized on said electrode;
  - (b) applying a voltage waveform effective to trigger electrochemiluminescence at said binding domain in the presence of a reaction medium suitable for conducting an electrochemiluminescence assay; and
  - (c) detecting or measuring electrochemiluminescence from said binding domain; wherein said detected or measured electrochemiluminescence correlates to the presence or amount of said analyte in said sample.
- 81. The method of claim 80, wherein the carbon particles comprise from 0.5% to 50% by weight of the composite.

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82. The method of claim 80, wherein the carbon particles comprise from 1% to 30% by weight of the composite.

- 83. The method of claim 80, wherein said binding reagent is covalently bound to said assay electrode.
- 5 84. The method of claim 80, wherein said binding reagent is non-covalently bound to said assay electrode.
  - 85. The method of claim 80, wherein said binding reagent is directly immobilized on said assay electrode.
- 86. The method of claim 80, wherein said binding reagent is indirectly immobilized on said assay electrode via a binding pair.
  - 87. The method of claim 80, wherein said assay electrode includes at least one additional binding domain.
- 88. The method of claim 80, wherein said binding reagent comprises an antibody or fragment thereof, a nucleic acid, a receptor or an enzyme.
  - 89. The method of claim 80, wherein said electrode comprises one or more additional binding domains having different binding specificities to provide for simultaneous binding of a plurality of different analytes of interest present in said sample.
  - 90. The method of claim 80, wherein said sample is a metered volume of sample.

91. The method of claim 80, further including a wash step.

- 92. The method of claim 80, further including a calibration step.
- 93. The method of claim 80, wherein one component of the 5 assay is stored in dry form and reconstituted by the sample.
  - 94. The method of claim 80, wherein said voltage is applied to two of said electrodes at different times.
  - 95. The method of claim 80, wherein said reaction medium includes an ECL coreactant.
- 10 96. The method of claim 80, wherein said electrochemiluminescent label is capable of repeatedly emitting
  electrochemiluminescence.
  - 97. The method of claim 80, wherein said electrochemiluminescent label comprises a metal.
  - 98. The method of claim 80, wherein said electrochemiluminescent label comprises an organometallic compound.
    - 99. The method of claim 80, wherein said electrochemiluminescent label comprises an organometallic compound selected from the group consisting of Ru-containing and Os-containing organometallic compounds.
    - 100. The method of claim 80, wherein, when said sample comprises said analyte, said contacting step results in the formation of a sandwich complex comprising said binding reagent,

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said analyte and said component.

- 101. The method of claim 80, wherein said analyte competes with said component for binding to said binding reagent.
- 102. The method of claim 80, wherein said analyte competes
  5 with said binding reagent for binding said component.
  - 103. The method of claim 80, wherein said analyte binds to said binding reagent.
  - 104. The method of claim 80, wherein said analyte binds said component.
- 10 105. The method of claim 80, wherein said analyte binds said binding reagent and said component.
  - 106. A method for conducting electrochemiluminescence binding assays for detecting or measuring a plurality of analytes of interest in a sample comprising:
- (a) contacting an assay electrode with a sample and one or more assay components linked to electrochemiluminescent labels, said assay electrode:
  - (i) comprising a composite containing a polymer matrix and a multiplicity of carbon particles dispersed therein; and
  - (ii) having a plurality of binding domains containing binding reagents, wherein said

binding reagents are immobilized on said
electrode;

- (b) applying a voltage waveform effective to trigger electrochemiluminescence at said binding domains in the presence of a reaction medium suitable for conducting an electrochemiluminescence assay; and
- (c) detecting or measuring electrochemiluminescence from said binding domains; wherein said detected or measured electrochemiluminescence at said binding domains correlates to the presence or amount of said analytes in said sample.
- 107. The method of claim 106, wherein at least two of said binding domains comprise binding reagents that differ in specificity for analytes of interest.
- 108. The method of claim 106, wherein the measured electrochemiluminescence at a first of said binding domains correlates with the presence or amount of a first analyte and the measured electrochemiluminescence at a second of said binding domains correlates with the presence or amount of a second analyte.

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